

curvature (foreshortened in Fig. 4).

Each of the extremes of the series is thus represented by about one third of the specimens, and the intergrades by the remaining third, but these intergrades are so numerous and the gradation is so perfect that it is quite impossible to separate the specimens into two series. Nor is there reason on other grounds for so doing. The specimens evidently all belong to one species exhibiting a high degree of secondary sexual variation in the male, a variation whose function and value have yet to be determined, but the key to which may perhaps be secured by careful observation of the habits of the species.

This character—the form of the anterior tibiae of the male—has been used for many years in systematic treatises for distinguishing the species of this genus but it is now evident that its worth has been greatly over-rated and it must be regarded with suspicion and in some cases as worthless for that purpose. In certain forms, of which I have examined considerable series, this great

variability apparently does not occur, the tibiae of the male and female being alike. The extremely bifurcate condition was recorded and figured by Mr. Scudder in characterizing *T. apicalis* Say and *T. terminalis* Scudd. (Boston Journ. Nat. Hist., vii, p. 424,—1862). The form I have treated above is the latter of these—*terminalis*; and from material in Mr. Scudder's collection I am able to state that at least the normal (♀) form of tibia is found in males of *apicalis* also. Possibly *terminalis* may prove to be but a race of *apicalis* but until the genus is revised it is best to regard them as different. *apicalis* appearing slightly larger, paler in color, and usually having relatively longer wings. Both of these forms are widely spread over at least the eastern half of the United States, and are apparently not uncommon locally. It is hoped that anyone having an opportunity to do so will make observations on the habits of these interesting little crickets and attempt to discover the use of this peculiar modification of the tibiae and its value to the insect.

## PULVINARIA INNUMERABILIS RATHV.

BY GEO. B. KING, LAWRENCE, MASS.

Although *Pulvinaria innumerabilis* Rathv. has been the subject of many published articles, together with illustrations of the species in its various stages of developments; it has become quite

evident to the writer, that a more clear and comprehensive description should be given together with some descriptive notes of its variation and distribution; moreover it is hoped that the following

description will enable any entomologist who may have the slightest knowledge of Coccidae, to recognize the species at once from any of its nearest allies. With this hope in view, the following description and notes have been carefully made and a large amount of material has been examined from various localities and food plants, so as to give their specific variation. Of course it is a well established fact, that the genus *Pulvinaria* is known by its producing a cottony ovisac, in which are deposited the eggs of the female scale. The color of the scales are variable, but in this species the typical color is red-brown, not at all shiny, elongate oval in shape, usually broader anteriorly, and always narrower posteriorly, 7 mm. long,  $5\frac{1}{2}$  broad. Boiled in caustic potash the following structural characters are observed.

Antennae 8-jointed, joint 3 always longest, 4 next, then 2 and 8 although sometimes 8 will be longer than 2. 5 is next and always longer than 6 or 7 which is the shortest and often equal. Front legs, with the coxa 120 long; femur and trochanter, 176; tibia, 164; tarsus 80; width coxa 20; trochanter 60; tibia 32; tarsus 20. Spines of lateral cleft in threes, one very long and stout, curved at the end 92 to 108 in length; two short and stout 32 to 40 long. The margin of the body is provided with a row of stout blunt spines 36 to 40 long, and a row of short, thin and sharp spine-like hairs 16 long; these are easily lost in dissecting. Between the antennae and above the anal plates, are several long thin hairs 48-92 and 120 in length; interspersed with these are some short spine-like hairs like those of the outer margin. Anal ring normal with six long stout bristles. The

arrangement of hairs on the several joints of the antennae are as follows: the first joint has three short spine-like hairs; the second, from one to two are long; the third from one to two; the fifth two to three; the sixth one; the seventh one to two; and the eighth seven to nine. The measurements of the several parts above, and those given in the tables are in micromillimeters.

A quantitative study of these variations is here given. It should be stated in this connection however, that intermediate individuals are found with the typical forms, which are sometimes quite small, and the reason for their size is no doubt due to being deprived of sufficient food, owing to the fact that they are found on the small twigs, where the supply of food is not so great as it is among the larger limbs of the tree, and it is here where the larger forms are found. These smaller forms do not differ materially in color, shape or structurally; all are practically the same. Specimens from Georgia are quite dark, variable in shape, some nearly hemispherical and in texture the scales are quite thick. Those from New Mexico are about the same in color and texture, but somewhat smaller. The scales on maple at Washington, D. C., are practically the same as those found on maple in Massachusetts. Those from Wisconsin (Div. Entom.) are quite different, being smaller and nearly black in color. Those from North Carolina are different still, practically hemispherical in shape, of a light brown color and quite small. Several lots of these specimens studied

ANTENNAL SEGMENTS. Table A.

Localities and Food Plants.	1	2	3	4	5	6	7	8	Size of the ♀ Scales.		
On sycamore, Atlanta, Georgia. (W. M. Scott, 1900.)	40	48	60	44	32	24	20	40	6½	mm. long.	6 broad.
On oak, Tifton, Georgia. (W. M. Scott, 1900.)	40	64	80	72	40	40	32	48	7½	"	" 6½ "
On elm, Atlanta, Georgia. (W. M. Scott, 1900.)	40	48	76	56	40	28	32	44	6½	"	" 5-4 "
On viburnum, Lawrence, Mass. (G. B. King, 1898.)	40	52	76	60	36	32	28	48	7	"	" 5½ "
On viburnum, Cambridge, Mass. (G. B. King, 1900.)	40	52	80	56	36	32	28	48	7	"	" 5½ "
On small tree in deep wood, Andover, Mass. (G. B. King, 1899.)	40	48	68	60	28	28	28	48	7	"	" 5½ "
On meadow-sweet, Methuen, Mass. (G. B. King, 1898.)									6½	"	" 6 "
	40	56	80	72	40	20	24	52	7	"	" 5½ "
On grape-vine, Lawrence, Mass. (G. B. King, 1897.)	40	48	60	56	36	24	24	40	7	"	" 5½-6½ "
On sumach, Dracot, Mass. (G. B. King, 1897.)	40	40	76	52	28	24	24	48	7	"	" 5½ "
	36	40	80	60	36	28	28	44	8	"	" 6 "
On poplar, East Las Vegas, N. M. (T. D. A. Cockerell, 1899.)	40	40	66	60	44	36	20	44	7	"	" 5½ "
On honey locust, East Las Vegas, N. M. (T. D. A. Cockerell, 1899.)	40	40	64	48	44	24	24	40	7	"	" 5 "
On virginia creeper, East Las Vegas, N. M. (T. D. A. Cockerell, 1900.)	40	52	84	64	40	28	24	48	6½	"	" 4½ "
									7	"	" 5 "
On maple, Wisconsin. (Div. of Entomology.)	40	52	64	52	40	24	28	40	5½	"	" 5 "
On maple, Washington, D. C. (Div. of Entomology.)	40	40	60	52	32	28	28	44	7	"	" 5½ "

FRONT LEGS OF THE SAME SPECIES. Table A.

	Coxa.	Femur with trochanter.	Tibia.	Tarsus.	Claw.
On sycamore, Atlanta, Georgia.	80	180	120	80	24
Broad.	80	40	24	16	
On oak, Tifton, Georgia.	80	176	164	80	"
On elm, Atlanta, Georgia.	100	200	160	80	"
On viburnum, Cambridge, Mass.	120	176	164	80	"
Broad.	80	40	24	26	
On small tree in deep wood.	80	172	140	68	
Broad.	80	48	20	16	"
On meadow-sweet, Methuen, Mass.	120	200	160	80	"
Broad.	84	50	28	24	"
On grape, Lawrence, Mass.	100	180	152	80	"
Broad.	80	60	32	20	
On sumach, Dracot, Mass.	98	168	140	80	"

Marginal spines.	Large spines of lateral cleft.	Small spines of same.
32 long	80	40
40 "	108	40
36 "	106	40
40 "	92	32
52 "	108	44
44 "	120	40
36 "	92	40
36 "	88	28
36 "	84	48

were so small, the color and texture of the scales also so variable that with the variation of the antennae and legs, I had

a very strong conviction that they should be separate and describe as subspecies; but certain structural characters, which are without doubt specific, being found in all of the material studied, they must be called forms of the same species. Whether these small forms are due to certain food, locality, season of the year being cold or warm, wet or dry, or the part of the food-plant upon which they were found, are all suggestive questions and have been carefully considered.

ANTENNAL SEGMENTS. Table B.

Localities and Food Plants.	1	2	3	4	5	6	7	8	Size of the ♀ Scales.	
On maple, Chicago, Ill. (Div. of Entomology.)	40	40	60	44	32	20	20	44	3 mm. in diameter.	
On coliseum ivy, Springfield, Mass. (Geo. Dimmock, Sept. 30, 1899.)	40	48	60	60	40	28	24	44	4½ mm. long.	3 broad
On white thorn, Methuen, Mass. (G. B. King, June 18, 1897.)	40	40	56	48	32	20	20	44	4	" " 3 "
On <i>Deutzia crenata</i> , Lawrence, Mass. (G. B. King, June 28, 1898.)	40	40	52	44	32	24	20	44	4	" " 3 "
On <i>Spiraea</i> , Lawrence, Mass. (C. B. King, June 10, 1897.)	40	40	48	48	28	20	20	40	5	" " 4 "
On tree in deep woods, Dracot, Mass. (G. B. King, June 8, 1899.)	40	40	64	52	36	28	28	44	5	" " 5 "
On cork oak, Methuen, Mass. (G. B. King, June 12, 1898.)	40	40	68	40	32	28	20	40	5½	" " 5½ "
On dogwood, Methuen, Mass. (G. B. King, June 26, 1898.)	36	40	60	48	32	24	24	48	3½	" " 2½ "

FRONT LEG OF SAME. Table B.

	Coxa.	Femur with trochanter.	Tibia.	Tarsus.
On maple Chicago, Ill.				
Length.	80	168	128	80
On coliseum ivy, Springfield, Mass.	100	180	140	80
On white thorn, Methuen, Mass.	80	160	140	80
Broad.	80	60	28	24
On <i>Spiraea</i> , Lawrence, Mass.	80	180	160	80
On cork oak, Methuen, Mass.	80	168	128	80
Broad.	80	60	32	24
On dogwood, Methuen, Mass.	100	160	120	84
Broad.	80	64	40	24

Marginal spines.	Large spines of lateral cleft	Small spines of same.
28 long	80 . .	32
36 "	" . .	"
32 "	" . .	28
40 "	" . .	40
32 "	" . .	40

The scales on white thorn were found August 18, 1898, upon the large branches. Those on Spiraea, June 15, 1897, upon the trunk and limbs. The scales on Coliseum ivy, Sept. 30, 1899. Those in the woods, June 16, 1899, on the large branches, on dogwood, June 10, 1898, were on the trunk, on maple at Chicago, Ill., August 10, 1900, and those on meadow sweet, June 25, 1897, on all parts of this small plant. It cannot be said that these forms are only occasional, or at all local, neither that they are found on a particular plant, and in such a position as not to get a full supply of nourishment; moreover I do not re-

member that the years in which they were found were exceptional. For convenience and also for future reference, I have prepared a separate table of these small forms marked, B. The characters to be observed in the determination of the species are:

Antennae 8-jointed, 3 and 4 longest: 5 always longer than 6 or 7 (the length of the fifth joint is very important) which are variable in length, although often equal and always the shortest. The short spine-like hairs of the first joint normally three, but often only two will be seen. The short spine-like hairs on the outer margin in front of the large blunt spines are also present with the long thin hairs between the antennae, and above the anal plates. The color and size of the scales counts for nothing, as there is every gradation in color from a light red-brown to almost clear black. And it should be said that the length of the first joint is only approximative, as in only a few instances can a specimen be mounted that will show this joint perfectly.

## LIFE HISTORIES OF NORTH AMERICAN GEOMETRIDAE.—XXII.

BY HARRISON G. DYAR, WASHINGTON, D. C.

*Sciagraphia heliothidata* Guenée. According to Dr. Hulst this species has the following synonymy: *ocellinata* Guen., *restorata* Walk., *subcolumbata* Walk., *duplicata* Pack. The larva has not been previously described.

*Egg.* Elliptical, well flattened above and below, one end slightly depressed, the other rounded truncate and a little swollen. Shining dark grass-green, almost olive color. Densely, finely reticulate, the cell areas concave, and, on the micropylar end, becoming large and strongly concave, look like the markings on a thimble, which is the cause of

this end looking swollen. Size .6 × .4 × .3 mm. Later turned dull dark red with central dark green nucleus. Hatched in five days.

*Stage I.* Head rounded, slightly bilobed, brownish luteous, ocelli black; held obliquely erect; width about .3 mm. Body moderate or rather thick, the incisures distinct; feet normal, pale. Uniformly sordid velvety olivaceous tinted, the tubercles rather large, slightly elevated, dusky, obscure. Dorsum and venter shaded, somewhat darker than the sides; no marks ex-